Paper L 18

PHOTOINTERPRETATION OF ERTS-A MULTISPECTRAL IMAGES ANALYSIS OF VEGETATION AND LAND USE FOR THE VALENCIA LAKE BASIN REGION

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ABSTRACT

The area under study includes part of the Central and Capital Region of Venezuela (coord: $9°30'$ – $11°00'$ lat. N. and $67°00'$ – $68°00'$ long. W). Climatic conditions define the existence of different ecological associations with biological forms well defined in their physiognomic complexity as they reach complete development in environments related to gross geomorphic units: Coastal area, Northern mountain range, fluvio-lacustrines plains, Southern mountain range, southern ridges and parts of Venezuelan central plains. In this area, rainfall varies from 600 mm to 2000 mm and evapotranspiration indexes indicate the existence of vegetation for semiarid conditions (tropical very dry forest) as well as vegetation for very humid conditions (very humid premontane forest).

This project has been designed with the following objectives:

● Location of areas with representative ecosystems for the purpose of managing planning.

● Identification of structural and physiognomic characteristics of vegetation.

● Assessment of human activity effects on environmental debasement.

● Definition of the content and possibilities of orbital ERTS images for the study of urban and rural land use.

● Setting photointerpretation patterns applicable to areas of similar gross environmental conditions.

During the first stage of the project, orbital images were analyzed at scales of 1:100,000 and 1:500,000 tonal differences were correlated with categories derived from Holdridge's method. Techniques utilized were the identification of tonal contrasts in false color composites esc. 1:1.000,000 (February and March 1973) and in bands 5 & 7, with the use conventional photointerpretation methods (magnifying glass and microfilm viewer).

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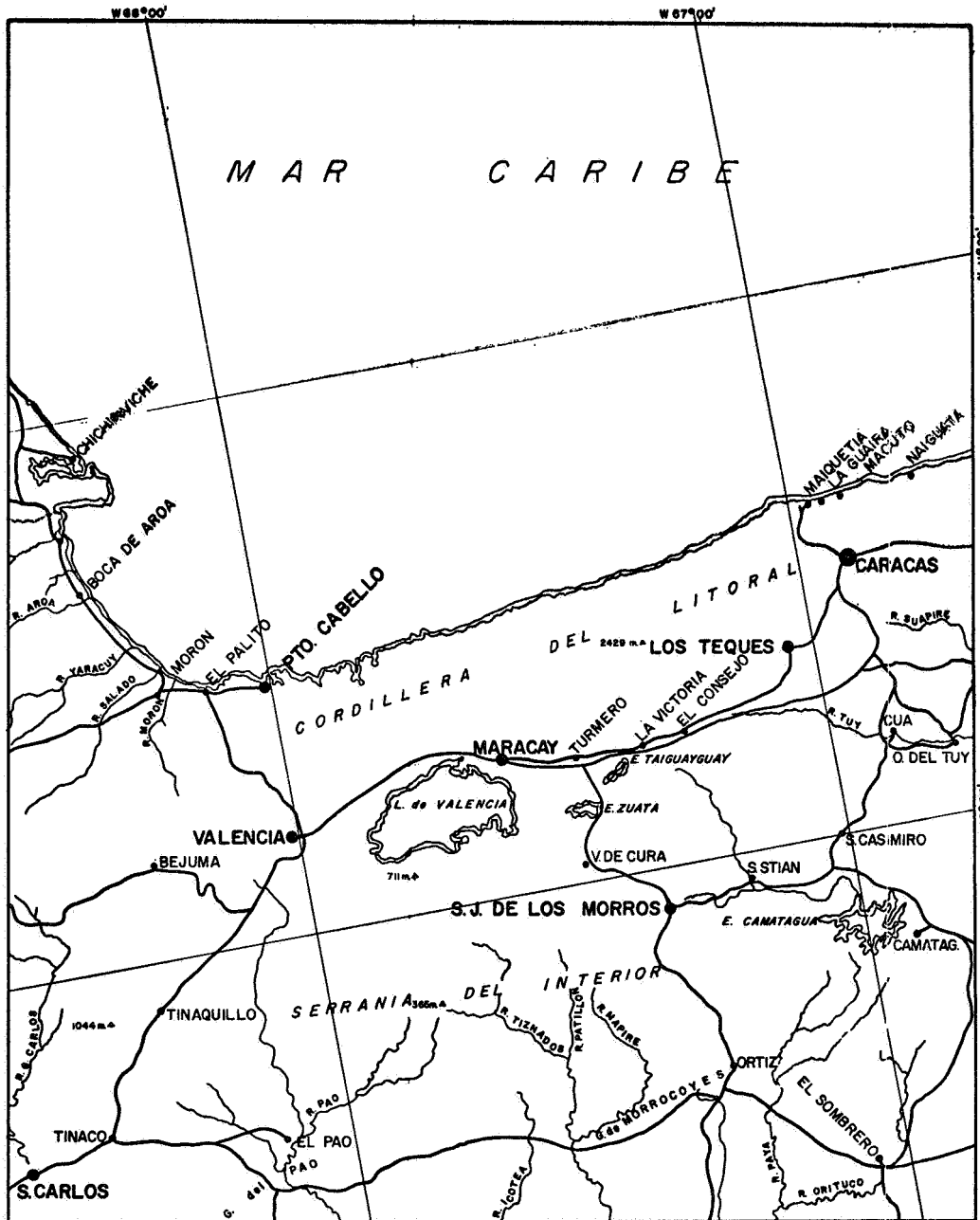
LOCALIZACION DEL AREA

ESC. 1:1.000.000

Figure 1.

Tonal variations were compared with those observed through a random 25% sample in conventional panchromatic photographs at scales of 1:50,000 and 1:25,000.

We have not arrived yet to a finished map at the scale of 1:500,000 with completely proved categories. Nevertheless, results obtained allow us to think it possible as well as to further precision to the 1:250,000 scale as soon as statistical work advances and permit the correlation of climatic conditions, geoforms and solar radiation to the tonal responses of vegetation.

As for the tectonic part of the project, conventional photointerpretation techniques were applied to multispectral images at the scales of 1:1,000,000 to obtain maximum information. At regional scale, principal faults trending E. were identified as they divide the area in tectonic blocks. Sedimentary rocks have been identified as well as folds, faults and small linears.

1. Regional Structure. The evaluation of geoforms and regional faults trending E. allowed N. to S. separation of principal tectonic blocks. Structural units of the area were identified and further analyzed with the help of drainage photointerpretation.

    Northern side of Coastal Range is separated of the La Guaira platform by Sebastian fault. The southern side of Coastal range is separated from "Serranía del Interior" by the La Victoria fault. A subsidence area is formed by the valleys of Valencia, Aragua, Santa Teresa and Santa Lucía. These intermontane valleys have a limit on the South at the normal E-W fault of Santa Rosa and at the piedmont of Serranía del Interior. Further on to the South, there can be observed a tectonic block formed by Paracotos Strip and the block of Villa de Cura. At the southernmost part of the study area, it is observed as a structural system of E-W lineaments almost parallel corresponding mostly to sandstone outcrops of Galeras del Pao.

    The La Guaira platform, located at the N. is covered by the Caribbean Sea and is separated from the Coastal Range by the Sebastian zone of faults, evident in the straight shape of the shoreline.

    In the tectonic block of the Coastal Range there were identified the fault of Tacagua and the fault zone of Macuto as well as some lineaments of the Valencia fault. In this block predominate incompetent rocks and the faulting pattern is oriented NW-SE, normal to the principal faulting system. A normal NE-SW lineament, of which there was no previous knowledge, was identified as the Petaquire fault.
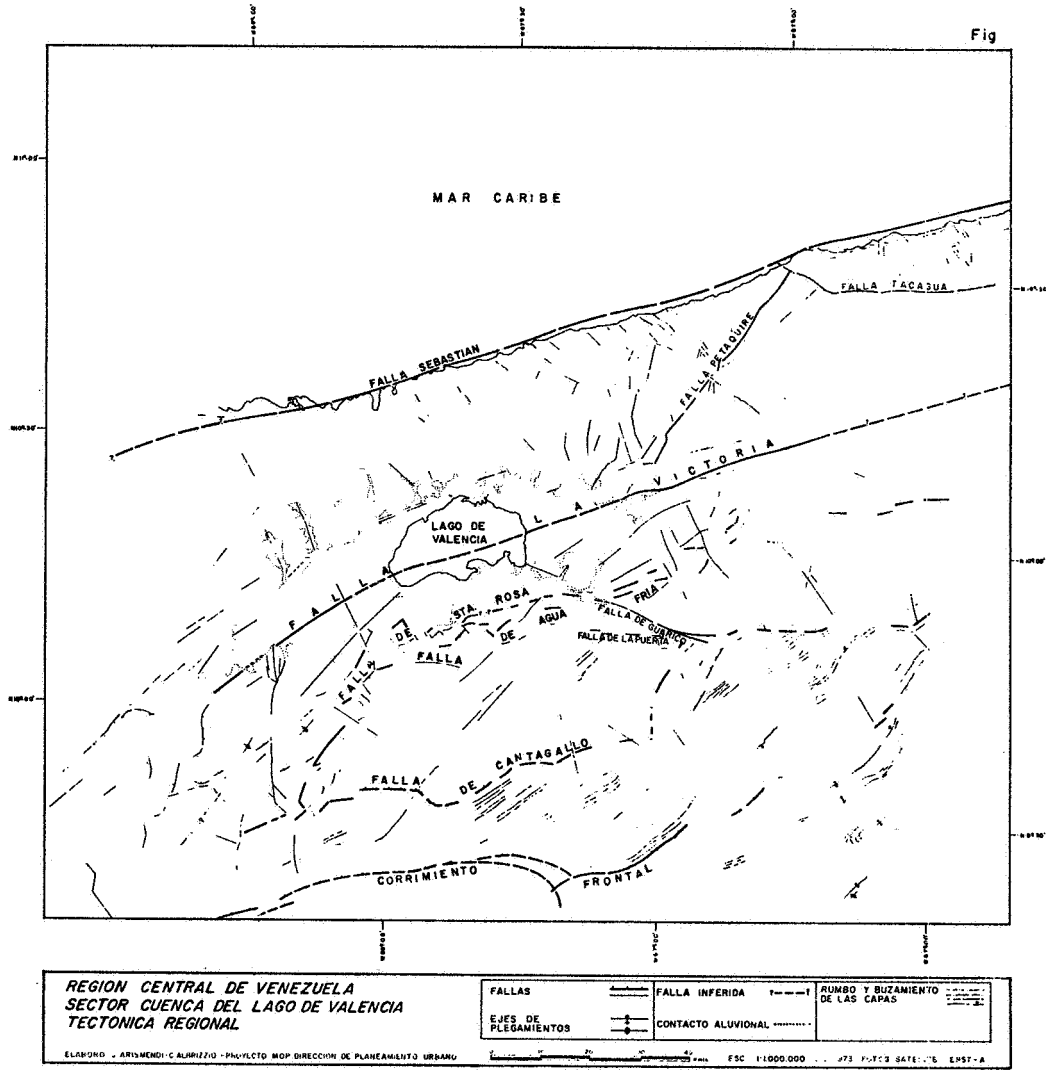
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Figure 2.

The fluvio lacustrine area of lago de Valencia is a depressed block.
Its principal structural characteristics are covered by Quaternary
sediments over Miocene rocks.

At the tectonic block of the Serrania del Interior, faulting pattern is
transversal. There were identified some features of the following
faults: Santa Rosa, Agua Fría, La Puerta and Guárico. The strip of
Paracotos is formed by a series of faulted blocks among volcanic
competent rocks.

At the block of Villa de Cura there were observed the fault of Cantagallo
(of difficult topographic expression) and the more recent fault of La
Puerta. Both faults contact the V. C. block with Upper Cretaceous rocks
of the mountain front.

The southern mountain front is folded and thrusted to the south as they
reach the limits of the Central Plains sedimentary basin.

2. Vegetation - photomorphic units. For the vegetation project, a first
   level was reached through the classification of tonal groups by aggre-
   gating tonal similarities to macrorelief units and sociological aspects
   of vegetation. There were identified the following units:

   a. Litoral - Predominant dry and very dry tropical forest.

   b. North and Central sector of Coastal Range - Predominant humid and
      very humid forest as well as premontane and lower premontane
      forest.

   c. South Sector of Coastal Range - Predominant humid premontane and
      dry premontane forest.

   d. Aluvial and Lacustrine Valleys of Aragua, Carabobo and Cojedes -
      Dry premontane forest and dry tropical forest.

   e. Interior Rangeland - Dry premontane forest, dry tropical forest and
      and humid premontane forest.

   f. Plains - Dry tropical forest.

3. Classification of Vegetation and Land Use Categories. At a second
   level of the analysis, tonal characteristics reached in the first level
   were detailed and separated according to ecological conditions deter-
   mined for photomorphic gross units. Classification was checked with

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REGION CENTRAL DE VENEZUELA
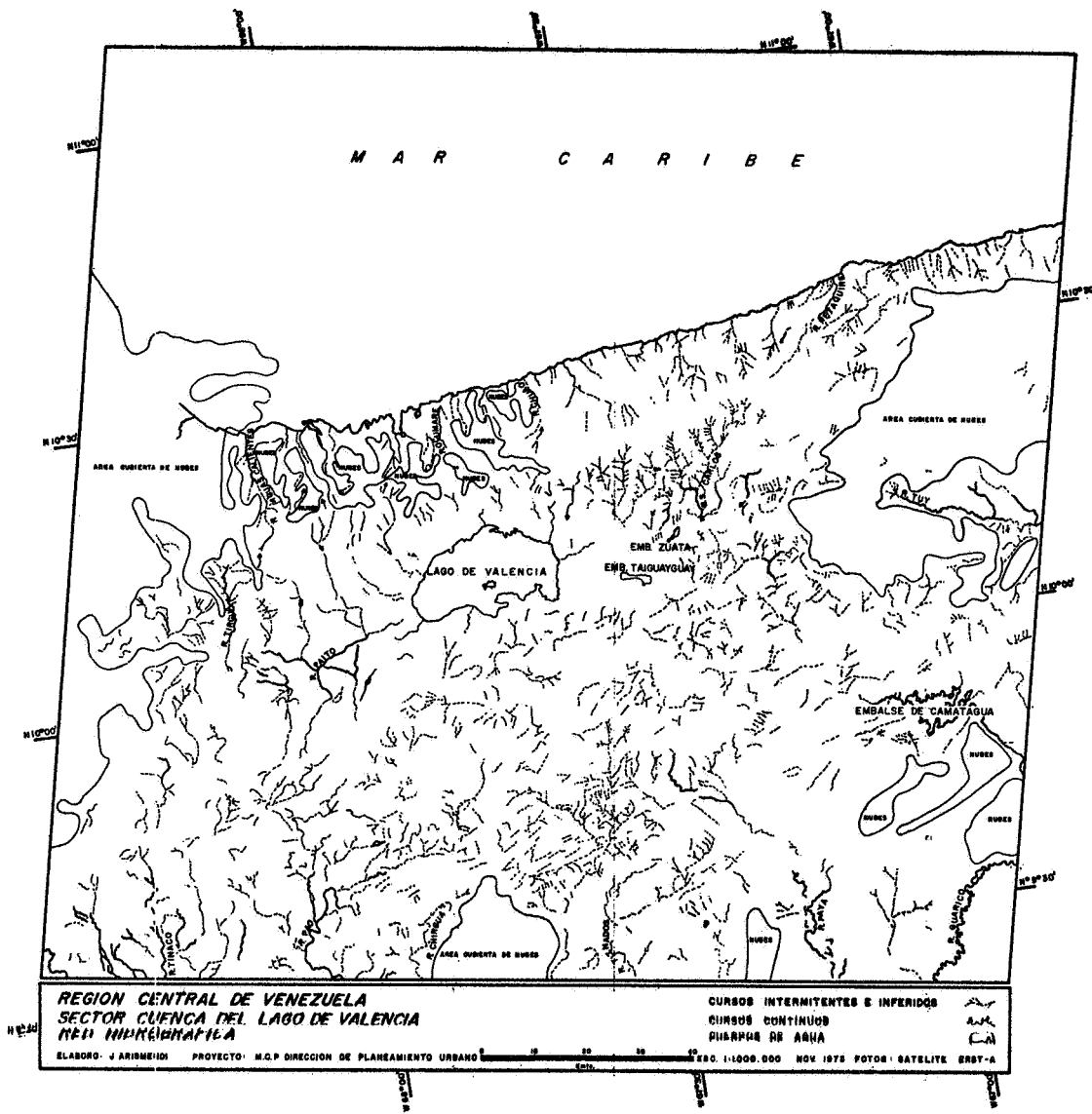SECTOR CUENCA DEL LAGO DE VALENCIA
RED HIDROGRAFICA

Figure 3.

samples ran in conventional 1:50,000 and 1:25,000 panchromatic photographs as well as with ground truth. Sampling allowed inference on the degree of human intervention, more exact definition of vegetal associational borders, agricultural types and some appreciation about density on the urban level.
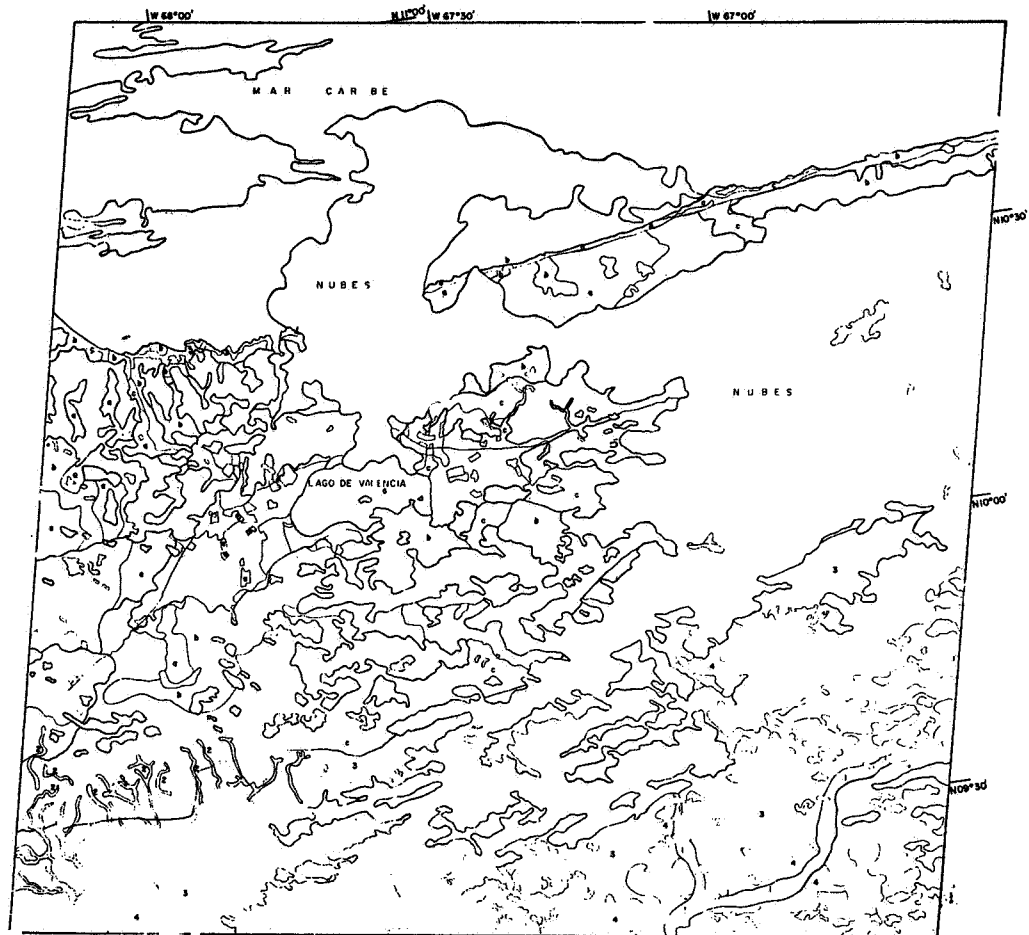
Categories identified were the following:

● Vegetation

● Dry and very dry tropical forest

● Dry tropical forest

● Dry premontane forest

● Humid premontane forest

● Humid tropical forest

● Very humid premontane and lower premontane forest

    a. Well developed gallery forest

    b. Regularly developed gallery forest

    c. Herbaceous vegetation scarcely developed with discontinuous arboreous and arbustive

    d. Herbaceous vegetation scarcely developed

    e. Burns

Each of the formerly mentioned vegetation categories has been qualified as follows: little intervention, medium intervention and very interveined.

Land use categories are the following:

● Urban area

● Industrial zones

● Vacant urban

● Airports

● Natural pastures

● Agricultural in big lots

● Sugar cane

● Agricultural in small lots

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W 68°00' N 10°00 W 67°30' W 67°00'

N 10°30'

M A R   C A R B E

N U B E S

N U B E S

LAGO DE VALENCIA

N 10°00'

N 09°30'

VEGETACION

☐ BOSQUE

☐ BOSQUE SECO TROPICAL

☐ BOSQUE SECO PREMONTANO

☐ BOSQUE HUMEDO PREMONTANO

☐ BOSQUE HUMEDO TROPICAL

☐ BOSQUE MUY HUMEDO PREMONTANO Y MONTANO BAJO

BOSQUES DE GALERIAS BIEN DESARROLLADOS

2 BOSQUES DE GALERIAS POCO DESARROLLADOS

3 VEGETACION HERBACEA POCO DESARROLLADA UNIDA A ESTRATO ARBUSTIVO Y ARBOREO DISCONTINUO

4 VEGETACION HERBACEA DE CORTO DESARROLLO

☐ ZONA DE QUEMAS

A POCO INTERVENIDO

B MEDIANAMENTE INTERVENIDO

C MUY INTERVENIDO

USO DE LA TIERRA

URBANO

☐ AREA URBANA

☐ ZONA INDUSTRIAL

☐ AREA VACANTE

☐ AEROPUERTO

RURAL

☐ PASTOS NATURALES Y CULTIVADOS

☐ CULTIVOS EN GRANDES PARCELAS

☐ CAÑA DE AZUCAR

☐ CULTIVOS EN MEDIANAS Y PEQUEÑAS PARCELAS

☐ CUERPOS DE AGUA

REGION CENTRAL DE VENEZUELA
CUENCA DEL LAGO DE VALENCIA

VEGETACION Y USO DE LA TIERRA

FEB 1973 POR SATELITE ERTS-A   IDENT N° 194 14192

Figure 4.

4. Evaluation. The geologic interpretation is comparable to the one we possess at scales of 1:200,000 drawn as photointerpreted from conventional 1:50,000 panchromatic images.

As for vegetation, the method used has permitted a diagnosis of actual conditions of vegetative coverage and the gross evaluation of the extension and quality of urban and rural land use. The repetitive character of images has been used (although not shown in this paper) to evaluate land use dynamics.

Tonal variations and its correlation with vegetational association is determined more exactly with false color composites due to plants chlorophil absortion of visibile light and reflection of I.R. In band 5, urban areas are easily identified and center part of cities (Maracay) can be delineated. Band 5 is also very sensitive to increase of biomass per unit area and tonal response is darker the more dense is the forest.

It is convenient to state the difficult task of approximating borders of vegetal formations due to ecotonal characteristics at transition levels.